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AN ECONOMETRIC ANALYSIS OF UNEMPLOYMENT INSURANCE BENEFIT ADEQUACY

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* In preparing this paper I benefitted from discussions with Ron Oaxaca, Mike Ransom, Dale Lehman, and Tim Bartik. Any errors are mine alone.

AN ECONOMETRIC ANALYSIS OF UNEMPLOYMENT INSURANCE BENEFIT ADEQUACY

ABSTRACT

Traditionally studies of unemployment insurance benefit adequacy have relied on an expenditure survey. This is expensive, yields small samples, and presumes that the analyst knows which categories of expenditure are necessary. This paper uses an existing large data set, and an agnostic approach. Labor supply are equations are estimated on PSID data using an estimator which accounts for rationing in the labor market. The results are used to compute labor market constraint compensation for comparison to payments under UI systems of representative states. The results suggest that payments which meet the accepted standard of adequacy would usually slightly overcompensate individuals.

AN ECONOMETRIC ANALYSIS OF UNEMPLOYMENT INSURANCE BENEFIT ADEQUACY

I. INTRODUCTION

The traditional approach to evaluating benefit adequacy is to question a sample of UI recipients about expenditures on a class of goods and services deemed "necessary," and compare their level of benefits to these expenses. Surveys of this type, although extremely valuable, have proven to be quite expensive. Becker (1961) noted that for the 1950s benefit adequacy studies "[t]he time spent per interview averaged about three hours, with a range from one to fourteen hours, exclusive of the time spent in reinterviews of the more difficult cases.[1] Results of the 1950s studies are summarized in Haber and Murray (1966). Blaustein and Mackin (1977) and Burgess and Kingston (1978a, 1978b) followed the same basic approach of the earlier studies. Recently, Cohn and Capen (1987) reported encouraging results from an approach which relied on household survey data.

While the use of readily available survey data reduces the cost of assembling the necessary information, a more fundamental problem in the general methodology remains. All of these studies presume that the analyst may determine which categories of expenditure are "necessary" or which items a household may least do without.

The 1950s studies focused on non-deferrable expenses in the categories of food, clothing, medical care, and housing. Blaustein and Mackin (1977) added expenditures made on a regular basis to repay outstanding debt to the 1950s definition and labeled this "recurring" expenses. Burgess and Kingston (1978a, 1978b) expanded the Blaustein-Mackin definition to include expenditures on transportation, insurance, regular services, and regular support payments and called it "necessary and obligated expenses." And Cohn and Capen (1987) expand the Bureau of Employment Security definition of minimum nondeferrable expenditures to include spending on child care, property taxes, dependents outside the house, transportation, and health.

The problems of sample size and expenditure category selection, are both remedied in the present study by using a readily available large data set, the Panel Study of Income Dynamics (PSID), and an agnostic approach to measuring unemployment compensation based on the economic theory of consumer-worker behavior. The methodology relies on a natural theoretical approach to estimating the upper list on unemployment compensation--solve for the lump sum payment, which, when given to an unemployed individual, makes him indifferent between his current lot and his pre-unemployment one.

[1]Becker (1961), p. 23.

Burgess, Kingston, and Sloane (1981) endeavored "to assess the feasibility of developing a benefit adequacy methodology that is based on econometric techniques."[2] But "(a)fter a substantial amount of experimentation with alternative transformations"[3] of the variables, they concluded that "the benefit adequacy measure analyzed cannot be predicted accurately for individual beneficiaries on the basis of detailed information about household income and composition."[4] Using a substantially different econometric technique for predicting individual UI compensation, this paper reaches a more sanguine result.

In its 1980 statement of policy positions the Interstate Conference of Employment Security Agencies recommended that "benefits should equal at least half of a beneficiary's wage."[5] The same position was enunciated Paul Douglas (1932) during debate over the establishment of a UI system. Cohn and Capen (1987) recently applied the one-half wage replacement standard of adequacy. The usual methodology has shown this norm to correspond roughly to the fundamental concern of satisfying the needs of the unemployed.[6] It has also been demonstrated to be consistent with the fiscal integrity of the program.[7] The present analysis subjects this norm to further scrutiny.

II. CONCEPTUAL APPROACH

Satisfaction of each consumer-worker is represented as depending simply on the market resources at her command, Y, and the time available to enjoy these resources, L. It is assumed that each individual, given her exogenous non-labor income, I, and the rate at which we can transform labor services, H, into income, w, if unconstrained in the labor market, acts in a manner consistent with the problem:

$$\max_{L,Y} (U(L,Y);\ Y = xH + I) = V(L(w,I),\ Y(w,I)). \tag{1}$$

She reaches an optimum where H(w,I) hours of work are supplied to the market and Y(w,I) goods are consumed in her residual discretionary time, L(w,I). Denoting T as the endowment of discretionary time, L(w,I) = T - H(w,I). In (1) V(w,I) is the indirect utility function which may be solved for non-labor income to obtain, I = E(s,V). The function E(w,V) gives the minimum

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[2]Burgess, Kingston, and Sloan (1981), p.1.

[3]Burgess, Kingston, and Sloan (1981), p. 18-19.

[4]Burgess, Kingston, and Sloan (1981), p. 23.

[5]Becker, 1980, p. 41.

[6]See Becker, 1980, Chapter 1.

[7]See Baily 1978.

unearned income necessary to reach the utility level V, given the wage rate w. Since $I = Y - xH$, E(w,V) is referred to as the excess expenditure function, because it determines the minimum lump sum income in excess of labor earnings needed to achieve a particular level of utility.

In many instances, the effective choice facing a consumer-worker is between working a standard day, week, or year or not working at all; in other cases an optimal wage-hour arrangement way be upset by an unexpected layoff. The analytic techniques required to investigate the effects of labor market constraints on consumer-worker behavior are formally similar to the methods used to evaluate the response to "straight rationing." Research on the effects of rationing began during World War II (see Rothbarth 1940-41, Kaldor 1941, and Nicholson 1942-43) and has continued to be popular (see Tobin-Houthakker 1950-51, Pollack 1971, Neary and Roberts 1980, and Lee and Pitt 1986).

Recently, Ashenfelter (1980) developed a model of household labor supply under rationing. This model has been applied by Blundell and Walker (1982), Deaton and Muellbauer (1981), Kneisner (1976), Parsons (1977), and Ransom (1987). Ham (1982) presented results based on a model of individual labor supply under rationing.

If a constraint on labor supply is set at $H = \underline{H}$, the problem for the consumer-worker degenerates. In this situation the level of satisfaction achieved by an individual is:

$$V^* = U(T - \underline{H}, Y(\underline{H}, w\underline{H} + I)) = \underline{V}(\underline{H}, I + w\underline{H}) \tag{2}$$

Equation (2) may be solved for the sum of non-labor income and exogenous labor income,

$$I + x\underline{H} = \underline{E}(\underline{H}, V^*), \tag{3}$$

transporting $w\underline{H}$, yields the constrained excess expenditure function,

$$I = \underline{E}(\underline{H}, V^*) - w\underline{H} \tag{4}$$

Two methods to measure the welfare loss experienced by labor market constrained individuals are developed here. Variants of the first technique, which is based on the work of Harberger (1971), have been used by Ashenfelter (1980) and Hurd (1980). A direct approach in the spirit of work by Rosen (1978), Hurd and Pencavel (1981), and Abowd and Ashenfelter (1981) is also investigated.

A Triangle Approximation to Full Compensation

Analytic derivation of a triangle approximation to full unemployment compensation may be neatly achieved under the Tobin-Houthakker (1950-51) assumption that the ration just bites. By Shepard's Lemma, differentiating E(w,V) with respect to the wage rate yields: $\partial E(w,V)/\partial w$

$= E_w(w,V) = L(w,V) - T = -H(w,V)$, the negative of the Hicksian labor supply function. Where the constraint just bites, $\underline{H} = H(w,V) = -E_w(w,V)$, and $V = V^*$. So that the required lump sum compensation can be stated as:

$$C(\underline{H}, w, V) = \underline{E}(\underline{H}, V) - w\underline{H} - E(w, V) \tag{5}$$

The difference between the exogenous cost of achieving the unconstrained utility level in the presence and absence of a ration. The quantity may also be written:

$$C(\underline{H}, w, V) = \underline{E}(-E_w(w,V), V) + wE_w(w, V) - E(w, V). \tag{6}$$

Since it is assumed that $V = V^*$, $C(\bullet) \simeq 0$; differentiating (6) with respect to w establishes $\partial\underline{E}/\partial\underline{H}- w = 0$, and differentiating a second time with respect to w yields $\partial^2\underline{E}/\partial\underline{H}^2 = 1/-E_{ww}$. Therefore, a second order Taylor Series approximation to $C(\bullet)$ around the fully employed point may be stated as:

$$C(\underline{H},w,V) \simeq (\partial\underline{E}/\partial\underline{H}-w)d\underline{H} + (1/2)(\partial^2\underline{E}/\partial\underline{H}^2)(d\underline{H})^2 = (1/2)(d\underline{H})^2/-E_{ww}. \tag{7}$$

And since $-E_{ww}$ is the first direct derivative of the compensated labor supply function $-E_{ww} = S_{Hw}$ the substitution effect of a wage change on labor supply. So that the approximation:

$$C(\underline{H},w,V) \simeq (1/2)(d\underline{H})^2/S_{Hw} \tag{8}$$

is simply one-half the squared duration of unemployment, $d\underline{H} = (H(w,I)-\underline{H})$, divided by the substitution effect (see Ashenfelter 1980, p. 553).

The triangle approximation to full unemployment compensation (8) is convenient and likely to be quite accurate when the duration of unemployment is short, but properly the approximation is correct only when the ration is set at the level that the individual would choose in the absence of rationing.

An Exact Solution for Full Compensation

If the notion of a representative structure for individual preferences can be accepted, a method for directly evaluating the required compensation to an individual constrained in selling labor services is immediate. The method developed here is based on just such an assumption and is in the spirit of work by Rosen (1978), who examined the excess burden of income taxation; Hurd and Pencavel (1981), who evaluated various wage subsidy programs; and Abowd and Ashenfelter (1981), who examined compensating wage differentials.

An individual faced with a binding constrain on the hours that he may sell in the labor market, at, say, $\underline{H} < H(w,I) = T\text{-}L(w,I)$, achieves a utility level less than that atainable in the absence of labor market rationing,

$$U(T-\underline{H},\ w\underline{H}+I) < U(L(w,I),\ Y(w,I)), \tag{9}$$

or in terms of the indirect utility function,

$$\underline{V}(\underline{H},\ w\underline{H}+I) < V(w,I) \tag{10}$$

Full unemployment compensation to an individual who is constrained in selling labor services is that lump sum grant, , which solves:

$$U(T-\underline{H},\ w\underline{H}+I+\ \ ) = U(L(w,I),\ Y(w,I)). \tag{11}$$

Stating this condition in terms of the indirect utility function,

$$\underline{V}(\underline{H},\ w\underline{H}+I+\ \ ) = V(w,I), \tag{12}$$

the nature of as a Hicksian equivalent variation is obvious. It is the compensation required by an individual who is constrained in the labor market to make him as well off as if he were employed at equilibrium hours. Therefore

$$\ \ =\ \ (w,I,\underline{H}) \tag{13}$$

is the compensation he would need to forego an opportunity to be employed at equilibrium hours.

III. EMPIRICAL STRATEGY

The approach to measuring full compensation proceeds from the estimation of a representative labor supply function. While only labor supply elasticity estimates are required to evaluate the triangle approximation to full compensation, to compute the exact solution utility function parameter estimates are required.

In addition to comparing the approximate and exact approaches to estimating full compensation, the sensitivity of the compensation estimates to preference structure assumptions is also examined. Deriving an explicit closed form solution to (13) is not always an easy matter. Three utility functions are examined here, they were chosen for their familiarity and tractability.[8] They are the Cobb-Douglas (CD), the Stone-Geary (SG) and the Constant Elasticity of

[8]See N.H. Stern (1986).

Substitution (CES). By sequentially examining these forms, the effect of relaxing assumptions on homotheticity and unitary elasticity of substitution are examined. These utility functions, and the associated labor supply functions, and compensation formulas are listed in Appendix A. To crystallize the approach, one particular case is now worked out in detail.

Exact Compensation in the Linear Expenditure System

The Linear Expenditure System is derived from the Stone-Geary utility function:

$$U(L,Y) = \alpha \ln(L-\gamma_1) + (1-\alpha)\ln(y-\gamma_2);\ 0 < \alpha_1, \tag{14}$$

where the parameters α and $(1-\alpha)$ are interpreted as marginal budget shares devoted to leisure and market goods, and γ_1 and γ_2 represent leisure and income origin translation parameters respectively. Maximizing (14) subject to the budget constraint, $Y = wH + I$, yields leisure demand,

$$L = \gamma_1 + (\alpha/w)((wT + I) - w\gamma_1 - \gamma_2), \tag{15a}$$

or labor supply,

$$H = (T-\gamma_1) - (\alpha/w)(I + w(T-\gamma_1) - \gamma_2), \tag{15b}$$

and commodity demand,

$$Y = \gamma_2 + (1-\alpha)((wT + I) - w\gamma_1 - \gamma_2), \tag{15c}$$

functions. Given the adding up condition on neoclassical demand functions, the parameters of (15a) through (15c) can be determined by estimating the parameters of any one of the demand system equations. Denoting the estimated parameter values by the parameters themselves, substitution of (15a) and (15c) into the right-hand side of (11) yields the right-hand side of equation (12).

the indirect Stone-Geary utility function. For this case the left-hand side of (12) is:

Equating (15) and (16) and solving for yields:

a closed form solution for full unemployment compensation when utility is Stone-Geary.

IV. EMPIRICAL RESULTS

The basic estimation was performed on a sample from Wave XV of the Panel Study of Income Dynamics (PSID) survey. This data was collected in the Spring of 1982, and describes respondent behavior during 1981. This particular wave of the PSID was selected since it contains extensive qualitative information on the presence of labor supply constraints. This information was used to classify individuals into one of three groups, underemployed (which includes unemployed), overemployed, and in equilibrium. Utility function parameters were estimated using a generalized Tobit method on explicit labor supply parameterizations. The sample was selected from 6,742 respondents to yield a group with characteristics which correspond to the model of individual consumer-worker behavior. A description of the characteristics of this sample is given in Appendix B.

Utility Function Parameter Estimates

The parameter estimates used to perform compensation simulations are reported in Table 1. They were estimated on a sample of single unattached individuals using data from Wave XV (1981 data) of the PSID, and a generalized Tobit maximum likelihood method. The likelihood function was composed of three parts, one for each possible labor market state: underemployed, overemployed, and at an equilibrium level of employment. The estimation was conducted using the Davidson-Fletcher-Powell algorithm in the GQOPT non-linear optimization program developed by Goldfeld and Quandt (1972). All results in this study are based on empirical labor supply equations which include only variables suggested by the theory. A complete discussion of these results, and the technique used to arrive at them, may be found in O'Leary (1986).

Since the forms estimated are generalization of one another, direct tests of the underlying structure of preferences for the simple labor-leisure choice model may be performed using the likelihood ratio. Considering the CD as a restricted version of SG and CES, in both cases the null hypothesis of CD form can be rejected at the one percent level of significance.[9] That is to

[9]Denoting the maximum value of the likelihood function when utility is assumed to be Cobb-Douglas as L(CD), and using similar notation for other forms, the test statistics are -21n(L(CD)/L(SG)) and -21n(L(CD)/L(CES)). Each of these quantities is distributed as a chi-square random variable with one degree of freedom, and each exceed the one percent critical value of 6.63 by a substantial amount.

say, both the particular CD type of homotheticity, and unitary elasticity of substitution between leisure and income may be rejected on the basis of this evidence. Not surprisingly, more rich parameterizations fit microeconomic labor supply data better.

Elasticity Estimates

Estimates of the structural Cournot wage effect, income effect, substitution effect, and associated elasticities are presented in Table 2 for each of the three functional forms. The results presented here are based on a combined sample of males and females. They are broadly consistent with the results of other “second-generation” research on labor supply.[10]

For purposes of computing triangle compensation estimates, substitution effect and elasticity estimates are of paramount importance. Although familiar and limited in number, the three forms chosen yield a good variety of reasonable results. In every case results for these parameters are consistent with the implication of consumer demand theory that the substitution effect on labor supply is positive. Furthermore, in each case leisure is found to be a normal good. In the CD case, since $\partial H/\partial w = [\alpha I/w^2]$, the wage elasticity of labor supply is necessarily positive; the magnitude of $\eta_{H.w}$ remains reasonable because of the strong income effect. The origin translation parameters in the SG case dramatically reduce both the income and substitution effects; SG yields the least elastic results. In the CES case the substitution effect is insufficient to dominate the income effect of normal leisure, resulting in a “backward bending” uncompensated labor supply curve.

Harberger Triangle Compensation Results

Results based on the Harberger triangle approximation are essentially simulation results where, given the parameter estimates, substitution effects and substitution elasticities are determined and used to estimate appropriate dollar and replacement rate compensation measures for various hypothetical degrees of labor market constraint.

In the 1982 Employment and Training Report of the President the U.S. Department of Labor reported that for the year 1981 (the year to which Wave XV of the PSID data relates) exactly half of all spells of unemployment experienced had a duration of twelve percent of the work year (six weeks) or less, while 27.6% were longer than 30% of the year, and 14% were of sufficient length (27 weeks) to completely exhaust UI benefits for an individual meeting the requirements for maximum benefit duration in any state of the union. The Labor Department figures refer only to actual separation from work. In the present analysis the magnitude of the shortfall from desired hours, a more general concept which also covers underemployment (working fewer than desired hours with no separation from work), is used to measure the degree

[10] For a summary of these other results see Killingsworth (1982).

of labor market constraint. Underemployment is measured here by the constrained shortfall from "desired" hours, desired hours being estimated by evaluating empirical labor supply functions at sample mean characteristics. This estimate of underemployment obviously varies across functional forms.

Harberger triangle compensation estimates, for degrees of unemployment in 5% (2 week) increments from five to fifty percent (26 weeks) of the work year, are reported in Table 3. The estimates were determined by evaluating C and C*, where $C^* = C/w_g d\underline{H}$ is the "full" replacement ratio, with w_g denoting the gross hourly wage rate. Differentiating $\bar{C}$ twice with respect to $d\underline{H}$, the Harberger triangle approximation to "full" dollar compensation is found to be increasing at an increasing rate in the degree of constraint; a similar operation shows C* to be increasing in a linear fashion with $d\underline{H}$.

While some results are outside the bounds of what seems reasonable, all are reported. For $D \leq .5$, in the CD and CES cases C* is always less than unity, but generally on the low side when compared to the standard norm of one-half wage replacement. For the SG case C* is less than one only for $D \leq .2$, and by the standard norm is excessive for longer durations.

Direct Compensation Simulation Results

Full compensation estimates based on the Direct formulae listed in Appendix A are presented for various hypothetical degrees of labor market constraint. These figures are reported together with UI payment simulation results for three states having benefit computation provisions which span the variety of systems extant.

Under all state Unemployment Insurance (UI) laws, a claimant's benefit rights depend on four principal factors: "the amount of employment and wages required to qualify an individual for benefits, the period for earning such wages, the method of computing the weekly benefit amount, and the method of determining the length of time for which benefits may be paid."[11] While the level of wages and period of employment for qualification differ greatly across the states, there exist only three basic schemes for determining a UI claimant's weekly benefit amount. They are referred to as the Average-weekly-wage, High-quarter, and Annual-wage formulae.

Results of simple simulations, performed under the assumption of qualification for the maximum benefit payment period, are presented for state programs representative of each of the three benefit schemes: Michigan provisions are used to perform Average-weekly-wage simulations (MI), California laws provide the parameters to do High-quarter simulations (CA), and Oregon's scheme is used to generate Annual-wage simulations (OR). The particulars of the four categories of benefit rights provisions in each of these states is summarized in Table 4. In

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[11]U.S. Department of Labor 1982, p. 3-1.

the third section of this table the examples highlight the distinguishing characteristics of the three general benefit schemes. Under each scheme a formula is employed which yields a weekly benefit amount (WBA) which is equal to about one-half of lost gross wages. Under the Michigan plan seventy percent of the net AWW is paid; in California a fraction between 1/24 and 1/31 of the HQ earnings is the WBA (the fraction (1/[(24 + 31)/2]) is used in the California simulation); and in Oregon the WBA is 1.25 percent of annual income.

Table 5 presents simulation results for all states and preference structures considered. The table is divided into three parts, one for each of the three utility functions. The first column lists the hypothetical number of weeks of unemployment (WEEK), which ranges from one to twenty-seven, and then thirty through fifty in increments of five weeks. The next three columns report the cumulative benefit payments which would be made to a qualified claimant with the various weeks of unemployment, and sample average gross hourly wage and CD preference structure in Michigan, California, and Oregon, respectively. Column five reports a dollar amount which equals half of the total gross wages lost, by an individual with the CD preference structure, mean wage rate, and mean non-labor income. And the sixth column is the amount of "full" compensation implied by the closed form direct compensation formula for $_1$ in Table A-3. In Michigan there is no waiting period before benefit payments begin. However, in California and Oregon the benefit payment is zero during the first full week of unemployment, with this waiting period acting as a form of coinsurance. The one-week waiting period was required in all but eleven states in 1981.[12] In all states, once benefit payments commence, total benefits increase in a linear fashion, with a fixed benefit amount being paid each week, until there is either a return to work or the claimant is no longer eligible.

It is assumed in the simulations performed here that the stylized claimant considered qualified for the maximum benefit period of twenty-six weeks. In the absence of economic conditions which trigger extended benefits, 26 weeks is the maximum benefit duration under most UI programs.[13] As a consequence of the waiting period and the benefit maximums, the figures in columns with the headings MI, CA, and OR in the simulation tables are constant for weeks of unemployment beyond twenty-seven. Just as the UI benefit totals increase in a linear fashion, so do the totals for one-half gross wage replacement (HALF).

Differentiating each compensation formula in Table A-3 with respect to H reveals that it is in general impossible to determine how a change in hours of work affects utility based compensation. However for the parameter values estimated, the simulation results suggest that full compensation is concave in duration.

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[12]The other ten states without a waiting week in 1981 were: Alabama, Connecticut, Delaware, Iowa, Kentucky, Maryland, Nevada, New Hampshire, Virginia, and Wisconsin.

[13]The exceptions (maximum duration in weeks) are: Louisiana (28), Massachusetts (30), Pennsylvania (30), Puerto Rico (20), Utah (36), Virginia (28), Washington, DC (34), and West Virginia (28).

Just as for the Harberger triangle approach, the results change substantially when the homotheticity restriction is relaxed. The "subsistence" parameters introduced in the SG case result in a larger share of the discretionary budget, or "supernumerary income," being devoted to market goods at the expense of leisure. Comparing these "full" compensation amounts with the figures for the actual benefit payments which would be forthcoming in the various states, the general result for the group of single householders analyzed here is that current UI programs overcompensate for wage loss in the early phase and, because of the maximum duration provisions, undercompensate for lengthy spells of unemployment. The norm of benefit adequacy, "one-half wage replacement," is met in the Michigan and Oregon simulations, and nearly satisfied for the case of California. This finding is not surprising. Becker (1980) documented the fact that single individuals with no dependents historically have been adequately compensated for lost earnings under state UI programs. In their sample of single persons from the PSID, Cohn and Capen (1987) find that 85% of non-deferrable expenses are replaced by UI benefits. Also, only in California for the cases of SG and CES would an individual with the sample mean wage and non-labor income not qualify for the maximum WBA.

Table 6 presents the wage replacement ratios (WRR) implicit in the figures reported in Table 5. From each of the 3 sections of Table 5, which relate to different utility functions, the columns labeled MI, CA, OR, and CD, SG, or CES are divided by two times the relevant column labeled HALF to yield Table 6. The linear payment schedule, combined with the absence of a waiting week in Michigan results in a constant WRR. The presence of a waiting week in California and Oregon result in a WRR which increases until benefits are exhausted.

Using the approximation that five weeks of unemployment in a given year amounts to a duration of unemployment, D, of ten percent, for ten weeks $D = .20$, and so forth the Harberger triangle compensation estimates may be compared with the closed form estimates of full compensation. For unemployment spells of short duration, there is a reasonably close correspondence. For long spells the correspondence breaks down. Overall the direct formulae yield more reasonable results.

VI. SUMMARY, CONCLUSIONS, AND POLICY IMPLICATIONS

Results from estimating explicit parameterizations of labor supply have been used to compute triangle approximation and direct closed form estimates of labor market constraint compensation. Underemployment compensation estimates are generated and compared to hypothetical payments which would accrue under the UI systems of representative states. Results on compensation amounts tend to support accepted standards of UI benefit adequacy. The Harberger triangle estimates accord quite closely with the direct compensation estimates when the duration of unemployment is short, but the direct compensation formulae have a wider range of applicability. For all levels of unemployment the direct compensation results indicate that "one-half gross wage replacement" would slightly over-compensate individuals from a utility based perspective.

The direct compensation and state program simulations imply that current UI programs overcomepnsate for wage loss during short spells of unemployment, and under-compensate for lengthy spells. On net compensation is adequate in the present UI system, but the timing of payments should be more closely examined.

When evaluating the present results it must be borne in mind that the underlying model is one of individual behavior, and the entire analysis was performed on a sample of single, unattached householders. The analysis was provided reasonable guidelines for future unemployment insurance policy directed toward this group; for example, increasing coinsurance. It has also suggested an item for future research in the area of household labor supply.

Table 1 A Comparison of Maximum Likelihood Utility Function Parameter Estimates for Various Functional Forms on the Total Sample[a]

Form	CD	SG	CES
α	.569 (87.0	.101 (3.9)	.321
γ_1	0*	3553.8 (40.9)	0*
γ_2	0*	662.3 (0.9)	0*
ρ	0*	0*	.974 (5.6)
σ_{LY}	1*	1*	.507
σ	1073.2	799.4	968.5
lnL	-911.0	-771.2	-845.1

* Implicitly restricted parameter values.

[a] T = 5840, asymptotic t-statistics in parentheses. Relying on the invariance property of Maximum Likelihood estimation, estimates of various utility function parameters were imputed from estimates of other parameters. Therefore t-values for some parameters are not reported.

σ = The standard error of the Tobit regression equation.

L = The value of the likelihood function at optimum.

Table 2. A Comparison of Partial Effect and Elasticity Estimates Implied by Maximum Likelihood Estimation of Various Functional Forms on the Total Sample[a]

Form	CD	SG	CES
H[b]	2316.7	2039.5	2134.5
$(\partial H/\partial w)$[c]	41.5	4.5	-108.0
$(\partial H/\partial I)$[d]	-0.12	-0.02	-0.12
S[e]	313.8	47.1	148.1
$(\eta_{H.w})$[f]	0.09	0.01	-0.24
$(\eta_{H.I})$[g]	-0.09	-0.02	-0.10
[h]	0.66	0.11	0.34

[a] Sample means: = 4.84, I = 1709.57, = 504.25.
[b] H = H(,I;); T = 5840.
[c] $(\partial H/\partial w)$ = Cournot wage effect
[d] $(\partial H/\partial I)$ = pure income effect
[e] S = substitution effect = $(\partial H/\partial w)-H(\partial H/\partial I)$
[f] $(\eta_{H.w})$ = wage elasticity = $(\partial H/\partial w)(\ /H)$
[g] $(\eta_{H.I})$ = income elasticity = $(\partial H/\partial I)(I/H)$
[h] = substitution elasticity = $(\eta_{H.w})-(\ H/I)(\eta_{H.I})$

Table 3. Harberger Triangle Full Dollar Compensation and Replacement Ratio Results Implied by the Various Utility Function Parameter Estimates by Degree of Constraint

	CD		SG		CES	
Form	C	C*	C	C*	C	C*
Degree						
D = .05	21.4	.04	110.5	.23	38.5	.07
D = .10	85.5	.08	441.8	.46	153.8	.15
D = .15	192.4	.11	999.1	.68	346.1	.22
D = .20	342.0	.15	1767.3	.91	615.2	.29
D = .25	534.4	.19	2761.4	1.14	961.3	.37
D = .30	769.6	.23	3976.5	1.36	1384.2	.44
D = .35	1047.5	.27	5412.4	1.59	1884.1	.51
D = .40	1368.2	.30	7069.3	1.82	2460.9	.59
D = .45	1731.6	.34	8947.1	2.05	3114.5	.66
D = .50	2137.8	.38	11045.8	2.27	3845.1	.74

Degree = D = $d\underline{H} / H(\quad, I; \quad)$ = constraint as a fraction of desired hours
C = $C(\underline{H}, w, V) \simeq (1/2)(d\underline{H})^2/S_{H.w}$ = dollar compensation amount
C* = $C/wd\underline{H} = (1/2)(d\underline{H}/H(w,I))/\qquad = (1/2)D/\qquad$ = optimal replacement ratio

Table 4. Benefit Rights Provisions in the State UI Laws of Michigan, California, and Oregon for the year 1981.[a]

	Michigan Average-weekly-wage (MI)	California high-quarter (CA)	Oregon Annual-wage (OR)
Base Period (BP)	52 weeks preceding BY	4 Quarters 4-7 Mos. before BY	1st 4 of last 5 Quarters
Benefit Year (BY)	year starting week of claim	year starting week of claim	year starting week of claim
To Qualify:			
Earnings	18 x 20 x min wage	\$1,200 in BP	\$1,000 in BP
Employment	18 weeks in BP	NS	18 weeks in BP
Weekly Benefit Amount (WBA)	.7 x Net AWW	1/24 to 1/31 of HQ earnings	.0125 x AW
Min-Max WBA	\$41 - \$182	\$30 - \$136	\$41 - \$158
To Qualify for Max WBA	NS	\$4,641 in HQ	\$12,600 in Year
Duration:			
Max:			
Weeks	26	26	26
Dollars	\$4,732	\$3,536	\$4,108
Min:			
Weeks	13	12	20
Dollars	NS	\$375	\$333

[a] Source: U.S. Department of Labor 1982, "Comparison of State Unemployment Insurance Laws," Manpower Administration, Unemployment Insurance Service, January.

NS = Not specified in the particular state law.

Table 5. Direct Full Dollar Compensation Simulation Estimates at Sample Means, and Simulation Estimates for Unemployment Insurance Compensation in Michigan, California and Oregon.[a]

WEEKS	MI	CA	OR	HALF	CD	MI	CA	OR	HALF	SG	MI	CA	OR	HALF	CES
1	182	0	0	152	4	182	0	0	132	17	182	0	0	137	6
2	364	136	158	303	14	364	125	158	265	62	364	129	158	273	23
3	546	272	316	455	32	546	250	316	397	128	546	258	316	410	51
4	728	408	474	607	56	728	376	474	530	211	728	388	474	547	88
5	910	544	632	758	86	910	501	632	662	307	910	517	632	683	134
6	1092	680	790	910	123	1092	626	790	795	414	1092	646	790	820	188
7	1274	816	948	1062	165	1274	751	948	927	529	1274	775	948	957	250
8	1456	952	1106	1213	213	1456	877	1106	1060	653	1456	904	1106	1093	319
9	1638	1088	1264	1365	266	1638	1002	1264	1192	783	1638	1034	1264	1230	395
10	1820	1224	1422	1517	324	1820	1127	1422	1325	919	1820	1163	1422	1367	477
11	2002	1360	1580	1668	387	2002	1252	1580	1457	1060	2002	1292	1580	1503	565
12	2184	1496	1738	1820	454	2184	1378	1738	1590	1205	2184	1421	1738	1640	658
13	2366	1632	1896	1972	526	2366	1503	1896	1722	1354	2366	1551	1896	1777	757
14	2548	1768	2054	2123	603	2548	1628	2054	1855	1507	2548	1680	2054	1913	860
15	2730	1904	2212	2275	684	2730	1753	2212	1987	1662	2730	1809	2212	2050	967
16	2912	2040	2370	2427	769	2912	1879	2370	2119	1821	2912	1938	2370	2187	1079
17	3094	2176	2528	2578	858	3094	2004	2528	2252	1982	3094	2067	2528	2323	1195
18	3276	2312	2686	2730	950	3276	2129	2686	2384	2145	3276	2197	2686	2460	1315
19	3458	2448	2844	2882	1046	3458	2254	2844	2517	2311	3458	2326	2844	2597	1438
20	3640	2584	3002	3033	1146	3640	2380	3002	2649	2478	3640	2455	3002	2733	1565
21	3822	2720	3160	3185	1249	3822	2505	3160	2782	2648	3822	2584	3160	2870	1695
22	4004	2856	3318	3337	1356	4004	2630	3318	2914	2819	4004	2713	3318	3007	1828
23	4186	2992	3476	3488	1465	4186	2755	3476	3047	2991	4186	2843	3476	3143	1964
24	4368	3128	3634	3640	1578	4368	2881	3634	3179	3165	4368	2972	3634	3280	2102
25	4550	3264	3792	3792	1694	4550	3006	3792	3312	3340	4550	3101	3792	3417	2243
26	4732	3400	3950	3943	1812	4732	3131	3950	3444	3516	4732	3230	3950	3553	2387
27	4732	3536	4108	4095	1934	4732	3256	4108	3577	3694	4732	3359	4108	3690	2533
30	4732	3536	4108	4550	2313	4732	3256	4108	3974	4233	4732	3359	4108	4100	2984
35	4732	3536	4108	5308	2994	4732	3256	4108	4636	5149	4732	3359	4108	4783	3774
40	4732	3536	4108	6067	3727	4732	3256	4108	5299	6083	4732	3359	4108	5467	4603
45	4732	3536	4108	6825	4505	4732	3256	4108	5961	7030	4732	3359	4108	6150	5464
50	4732	3536	4108	7583	5323	4732	3256	4108	6623	7988	4732	3359	4108	6833	6351

[a] These results were generated using mean values of the marginal tax rate (τ = .205), the gross wage rate (w_g = \$6.51), and non-labor income (I = \$1709.57) from the total sample of 857 used for the basic estimation.

WEEKS = Annual number of weeks unemployed
MI = Compensation payable in Michigan, an Average Weekly Wage state.
CA = Compensation payable in California, a High Quarter state.
OR = Compensation payable in Oregon, an Annual Wage state.
HALF = Half of lost gross wages
CD = Full compensation at the means given Cobb-Douglas utility
SG = Full compensation at the means given Stone-Geary utility
CES = Full compensation at the means given Constant Elasticity of Substitution utility.

Table 6 Direct Replacement Ration Simulation Estimates at Sample Means, and Simulation Estimates for Unemployment Insurance Compensation in Michigan, California, and Oregon[a]

WEEKS	MI	CA	OR	CD	MI	CA	OR	SG	MI	CA	OR	CES
1	.600	.000	.000	.012	.687	.000	.000	.064	.666	.000	.000	.022
2	.600	.224	.260	.024	.687	.236	.298	.117	.666	.236	.289	.042
3	.600	.299	.347	.035	.687	.315	.398	.161	.666	.315	.385	.062
4	.600	.336	.391	.046	.687	.355	.447	.199	.666	.355	.434	.080
5	.600	.359	.417	.057	.687	.378	.477	.232	.666	.378	.462	.098
6	.600	.374	.434	.067	.687	.394	.497	.260	.666	.394	.482	.115
7	.600	.384	.446	.078	.687	.405	.511	.286	.666	.405	.495	.131
8	.600	.392	.456	.088	.687	.414	.522	.308	.666	.414	.506	.146
9	.600	.399	.463	.097	.687	.420	.530	.328	.666	.420	.514	.161
10	.600	.404	.469	.107	.687	.425	.537	.347	.666	.425	.520	.175
11	.600	.408	.474	.116	.687	.430	.542	.364	.666	.430	.526	.188
12	.600	.411	.477	.125	.687	.433	.547	.379	.666	.433	.530	.201
13	.600	.414	.481	.134	.687	.436	.550	.393	.666	.436	.534	.213
14	.600	.416	.484	.142	.687	.439	.554	.406	.666	.439	.537	.225
15	.600	.418	.486	.150	.687	.441	.557	.418	.666	.441	.540	.236
16	.600	.420	.488	.158	.687	.443	.559	.430	.666	.443	.542	.247
17	.600	.422	.490	.166	.687	.445	.561	.440	.666	.445	.544	.257
18	.600	.423	.492	.174	.687	.446	.563	.450	.666	.446	.546	.267
19	.600	.425	.493	.182	.687	.448	.565	.459	.666	.448	.548	.277
20	.600	.426	.495	.189	.687	.449	.567	.468	.666	.449	.549	.286
21	.600	.427	.496	.196	.687	.450	.568	.476	.666	.450	.551	.295
22	.600	.428	.497	.203	.687	.451	.569	.484	.666	.451	.552	.304
23	.600	.429	.498	.210	.687	.452	.570	.491	.666	.452	.553	.312
24	.600	.430	.499	.217	.687	.453	.572	.498	.666	.453	.554	.320
25	.600	.430	.500	.223	.687	.454	.573	.504	.666	.454	.555	.328
26	.600	.431	.501	.230	.687	.455	.573	.510	.666	.455	.556	.336
27	.578	.432	.502	.236	.662	.455	.574	.516	641	.455	.557	.343
30	.520	.389	.451	.254	.595	.410	.517	.533	.577	.410	.501	.364
35	.446	.333	.387	.282	.510	.351	.443	.555	.495	.351	.429	.394
40	.390	.291	.339	.307	.447	.307	.388	.574	.433	.307	.376	.421
45	.347	.259	.301	.330	.397	.273	.345	.590	.385	.273	.334	.444
50	.312	.233	.271	.351	.357	.246	.310	.603	.346	.246	.301	.465

[a] These results were generated using mean values of the marginal tax rate ($t = .205$), the gross wage rate ($w_g = \$6.51$), and non-labor income ($I = \$1709.57$) from the total sample f 857 used for the basic estimation.

WEEKS = Annual number of weeks unemployed
MI = Replacement ratio in Michigan, an Average Weekly Wage state.
CA = Replacement ratio in California, a High Quarter state.
OR = Replacement ratio in Oregon, an Annual Wage state.
CD = Replacement ratio given full Cobb-Douglas compensation.
SG = Replacement ratio given full Stone-Geary compensation
CES = Replacement ratio for full Constant Elasticity of Substitution compensation.

APPENDIX A
FUNCTIONAL SPECIFICATION

Explicit forms for three distinct, but related utility functions, U(L,Y), are presented in Table A-1, the associated labor supply functions, H(w,I), are stated in Table A-2, and closed form formulae for full unemployment compensation (w,I, H) are given in Table A-3.

Table A-1 Utility Functions

Cobb-Douglas

$U(L, Y; \alpha) = L^{\alpha}Y^{1-\alpha}; 0 < \alpha\ 1$

Stone-Geary

$U(L,Y; \alpha, \gamma_1, \gamma_2) = \alpha \ln(L-\gamma_1) + (1-\alpha)\ln(Y-\gamma_2); 0 < \alpha < 1$

Constant Elasticity of Substitution

$U(L, Y; \alpha, \rho) = [\alpha(L)^{-\rho} + (1-\alpha)(Y)^{-\rho}]^{(-1/\rho)}$; $0 < \alpha\ 1$, and $-1 < \rho < 0$ or $0 < \rho$, and $\rho \neq 0$.

Table A-2 Labor Supply Functions

Cobb-Douglas

$H_1 = H(w, I; \alpha) = T(1-\alpha) - \alpha(I/w)$

Stone-Geary

$H_2 = H(w, I; \alpha, \gamma_1, \gamma_2) = (1-\alpha)(T-\gamma_1) - \alpha(I/w) + \alpha\gamma_2(1/w)$

Constant Elasticity of Substitution

$H_3 = H(w, I; \delta, \sigma_{LY}) = [\delta(w)^{(\sigma_{LY})}T-I] / [\delta(w)^{(\sigma_{LY})} + w]$;

$\sigma_{LY} = [1/(1+\rho)]$, and $\delta = [(1-\alpha)/\alpha]^{(\sigma_{LY})}$

Table A-3 Closed Form Direct Compensation Formulae[a]

Cobb-Douglas

Stone-Geary

Constant Elasticity of Substitution

[a] The above three equations are closed form solutions for labor market constraint compensation. They are derived in the same fashion as (18) in Section II of the text. In the equation for , H_3 refers to the expression in Table A-2.

APPENDIX B
SAMPLE SELECTION

To arrive at a sample of unattached individuals the sample was limited to unmarried persons (which reduced the sample to 2,888), who lived alone (this reduced the sample to 1,585), and had no dependents (this reduced the sample to 1,319). The sample was reduced further due to labor force status considerations. Of the 1,319 single householders remaining in the sample, 462 were observed as having a zero hourly wage. Annual hours of work were also reported as zero for all but two of these individuals (positive hours for these two may have been due to a coding error). The methods developed by Heckman (1974, 1976, 1979) for application to female labor supply seem natural here; however, of the 460 respondents with zero hours and wages 438 (205 retired, 96 permanently disabled, 4 students, and 133 others), or 95.2 percent, were out of the labor force in some permanent sense. The decision was made to restrict analysis to the 857 with positive hours and wages out of the subsample of 1,319.

The analysis is conducted on a sample from a small proportion of the total population, so the potential for generalizing the results to national levels is limited. However, as can be seen in Table B-1, the sample mirrors the growing national population of single householders, in all respects except race and sex. Money Income of Households, Families, and Persons in the United States: 1981 (U.S. Department of Commerce 1983) reports that out of a total of 83.527 million households in the United States, 19.354 million or 23.2 percent were composed of a single person in 1981. While only 13.2 percent of these were minority householders and 38.7 percent were male, the average gross total income for these single person households was $12,774. The sample mean values for age, years of schooling, and extent of unionism compare favorably with the general working age population.

Table B-1 Characteristics of the Subsample of 857 Single Householders Selected from the Wave XV of the PSID

Variable	Mean	Minimum	Maximum	Description
Hours	1675.27	8.00	5606.00	Hours worked in 1981
Net Wage	4.84	0.14	32.38	Net Hourly Wage Rate
Net Non-labor	1709.57	0.00	29640.00	Net Property Income
Tax Rate	0.21	0.00	0.68	Marginal Tax Rate
Sex	0.47	0.00	1.00	Male = 1, Female = 0
Age	35.26	17.00	82.00	Age in Years
Education	12.50	0.00	17.00	Years of Schooling
Race	0.60	0.00	1.00	White = 1, Else = 0
Union	0.14	0.00	1.00	Member = 1, Else = 0

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